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(54) [Title of the Invention] METHOD FOR PROCESSING A  
STRUCTURED COMPOUND FOR THE DEODORIZATION THEREOF

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(57) [Claims]

[Claim 1] Method for processing a structured compound for the deodorization thereof which is obtained by using the ground paste or chopped pieces of fish meat as a material in combination with a supplementary material as needed, and exposing the material to high temperature and high pressure to convert it into a structured compound, the method comprising freezing the structured compound and then heating the same.

[Claim 2] Method for processing a structured compound for the deodorization thereof which is obtained by using the ground paste or chopped pieces of fish meat as a material in combination with a supplementary material as needed, and

exposing the material to high temperature and high pressure to convert it into a structured compound, the method comprising treating the structured compound by heating it in a solution containing an oxidizing agent or a reducing agent.

[Claim 3] Method for processing a structured compound for the deodorization thereof which is obtained by using the ground paste or chopped pieces of fish meat as a material in combination with a supplementary material as needed, and exposing the material to high temperature and high pressure to convert it into a structured compound, the method comprising freezing the structured compound, and then

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treating the structured compound by heating it in a solution containing an oxidizing agent or a reducing agent.

[Detailed Description of the Invention]

[Technical Field of the Invention]

The present invention relates to a novel method for processing a structured compound for its deodorization.

[Description of the Related Art]

With regard to food products such as fish-meat sausages, canned fish-meat, etc., obtained by using fish-meat as a material and treating it by heating at high temperature, generally proteins of the meat undergo thermal decomposition to produce hydrogen sulfide and other decomposition products which develop an objectionable odor. The odor will often seriously damage the quality of the food product.

Recently, the twin screw cooking extruder is used for processing fish-meat where fish-meat is exposed to high temperature and high pressure so as to produce a fiber-structured compound which will give, because of its having a structure resembling the texture of crab meat or livestock meat, an agreeable eat feeling. Thus, such structured compounds have been accepted avidly by many consumers. However, when fish-meat is processed by means of a twin screw extruder, the fish-meat must be heated at a higher temperature (150°C or higher) than is observed in the processing of fish-meat sausages, and thus the meat develops a far stronger objectionable odor. The main factor responsible for the strong odor is hydrogen sulfide. To prevent this objectionable odor, attempts have been made to add a deodorizing agent such as sodium sulfite to the material so that the odor can be suppressed, but the result is not always satisfactory. Therefore, unless the structured compound is subjected to secondary treatment for the complete elimination of such objectionable odor, the compound poses a serious problem particularly when it is used as a material for the preparation of other food products.

The present invention aims to offer a solution to this problem by providing a method for satisfactorily eliminating the objectionable odor of a structured compound obtained by

means of an extruder.

[Summary of the Invention]

The present invention provides a method for processing a structured compound for its deodorization which is obtained by using the ground paste or chopped pieces of fish meat as a material in combination with a supplementary material as needed, and exposing the material to high temperature and high pressure to convert it into a structured compound, the method comprising freezing the structured compound and then heating it.

In a second embodiment of the invention, the method for processing a structured compound for its deodorization comprises treating the structured compound by heating it in a solution containing an oxidizing agent or a reducing agent. In a third embodiment of the invention, the method for processing a structured compound for its deodorization comprises freezing the structured compound, and then treating the structured compound by heating it in a solution containing an oxidizing agent or a reducing agent.

[Detailed Description of the Invention]

The present invention will be described in detail below.

In this invention, the ground paste or chopped pieces of fish meat is used as a material. The fish-meat may be prepared by taking the body of mackerel, sardine, pollock, Atlantic cod, etc., removing it of inedible parts such as

the head, scales, viscera, bones, etc., and chopping the remaining muscle mass into pieces with a fish-meat processor or exposing the muscle mass to running water for a while for curing and grinding it into a paste. The meat from crabs or shrimps as well as the one from various shell-fishes, and other mollusks may be used. The meat may be collected from a single species, or from two or more different species.

The material used in the invention may consist exclusively of fish-meat, but may include, in addition to fish-meat, a supplementary material as needed comprised of various ingredients. The supplementary material may include wheat flour, soy bean flour, potato starch flour or the like.

Any one may be selected from what is cited above, and its addition amount may be determined as appropriate according to a given purpose. It is possible to obtain a variety of food products comprising a single structured compound by selecting a supplementary ingredient(s) from various candidate ingredients and varying its addition amount. In addition to the supplementary material, the material may include an additive(s) such as a seasoning, coloring agent, etc.

According to the present invention, the ground paste or chopped pieces of fish-meat must be exposed to high temperature and high pressure together with a supplementary material to be added to the fish-meat as needed, and for

this purpose, generally a twin screw cooking extruder is used. As is widely known, the extruder can treat fish-meat material thermally as well as mechanically. Specifically, the extruder has an ability to receive fish-meat material to transfer it to a chamber where the material is compressed, mixed, kneaded, cut, heated, sterilized, and expanded so that it can be extruded to produce a structured compound, that is, an ability to perform these procedures in a short period of time. The machine has been used for the preparation of various food products. The extruder is composed of five components such as a feeder, barrel, screw, die, and heater (or cooler). In addition, a conductive nozzle in the form of a flat plate, disc, or double-sectioned cylinder may be attached to or detached from the distal end of the die as needed, or the conductive nozzle may be integrally formed with the die.

The condition under which fish-meat is treated in an extruder may be determined as appropriate. However, the extruder is preferably adjusted as follows: feeding of a material consisting of the ground paste or chopped pieces of fish meat to which a supplementary material and/or an additive(s) is added as needed occurs at 50 to 3000 g/min; the screw spins at 100 to 150 rpm; and the temperature of the barrel is kept at 70 to 200°C. When a conductive nozzle is attached to the die, the material should be heated to a

sufficiently high temperature to give a homogeneous melt at the distal end of the axis of the machine, followed by further heating of the material during its passage through the proximal half of conductive nozzle. Or preferably the material is allowed to pass intact through the proximal half of conductive nozzle to be given a desired structure, and then be cooled during its passage through the distal half of conductive nozzle to such an extent that the extruded structured compound has a temperature of 100°C or lower.

Thus, according to one embodiment of the present invention, the structured compound obtained after exposing fish-meat to high temperature and high pressure is frozen and then heated. In the actual process, the structured compound is frozen by being cooled at about -30°C to -10°C, preferably not higher than about -20°C, and then the compound is heated by immersing it for 1 hour or longer in a bath containing boiling water having an appropriate volume, for example, 10 times as large as that of the compound. Since the solubility of a substance rises as its temperature lowers, hydrogen sulfide present in the structured compound readily dissolves to water contained in the compound when the compound is frozen at the initial step. When the compound is heated thereafter, water in the compound containing dissolved hydrogen sulfide disperses and escapes the compound to enter into the surrounding water carrying

hydrogen sulfide in association to allow it to be volatilized which permits the efficient elimination of this main odorous factor.

According to a second embodiment of the invention which spares use of the freezing step, the structured compound is directly submitted to heating treatment which consists of heating the compound in a solution containing an oxidizing agent such as potassium bromate, hydrogen peroxide, etc. or a reducing agent such as ascorbic acid, sodium sulfite, etc.

According to this treatment method, the additive is generally added at 0.05 to 0.5% in volume with respect to the volume of water which is 10 times as large as that of the compound. The compound is boiled in this solution for 30 minutes or longer. This procedure will convert hydrogen sulfide into an insoluble odorless substance.

According to a third embodiment of the invention, the structured compound obtained as above is frozen (or refrigerated) by being cooled at about  $-30^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$ , preferably not higher than about  $-20^{\circ}\text{C}$ , and then the compound is treated by heating it in a solution containing an oxidizing agent or a reducing agent as described above. According to this embodiment, it is possible not only to remove hydrogen sulfide from the compound but also to render hydrogen sulfide remaining in the compound odorless, which further enhances the deodorizing activity of the process.



The inventors noticed further that if the heating treatment is performed while ozone is allowed to develop, the deodorizing activity of the process is further enhanced.

[Examples]

The present invention will be illustrated further with reference to Examples and Test Example.

Example 1

A 100 kg of the ground paste of meat from Atlantic cod and 5 kg of potato starch flour were put in a twin screw cooking extruder (Suehiro Iron Works Co.) equipped with a cooling die in the form of a cylinder having a diameter of 24 mm where the meat paste was exposed to high temperature and high pressure. The material was fed at a speed of 500 g/min; the screw spun at 200 rpm; and the temperature of the barrel was kept at 200°C. The resulting structured compound was frozen at -20°C or lower, and then it was boiled for 1 hour in hot water kept at 95°C having a volume 10-times as large as that of the compound.

Example 2

A structured compound in the form of a strip having a thickness of 7 mm was obtained by processing fish-meat as in Example 1. The compound was put in a 0.05% aqueous solution of potassium bromate to serve as an oxidizing agent (which was added to water having a volume 10 times as large as that of the compound) and boiled there at 95°C for 30 minutes.

### Example 3

A structured compound was obtained as in Example 1 except that a cylindrical cooling die having a diameter of 26 mm was used instead of the cooling die having a diameter of 24 mm. The compound was put in a 0.1% aqueous solution of sodium sulfite to serve as a reducing agent (which was added to water having a volume 10 times as large as that of the compound) and boiled there at 95°C for 1 hour.

### Testing Example

The three kinds of structured compounds having undergone the respective deodorization treatments of Examples 1, 2 and 3 were submitted to a sensation test for the presence of objectionable odor based on the evaluation of ten testers. Each tester evaluated the presence of objectionable odor according to the following five-stage scale:

Bad mark    Sensation intensity

- 5    Feels a very strong objectionable odor.
- 4    Feels a strong objectionable odor.
- 3    Feels a weak objectionable odor.
- 2    Feels a faint objectionable odor.
- 1    Feels no objectionable odor.

The results obtained are listed in the table below.

Bad mark ascending	1	2	3	4	5
Example 1	6	4	0	0	0
Example 2	4	6	0	0	0
Example 3	9	1	0	0	0

To the structured compound which received no deodorization treatment, all the testers gave bad mark 5.

[Advantages] A structured compound obtained by processing fish-meat in an extruder where the fish-meat is exposed to high temperature and high pressure has an objectionable odor

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due to hydrogen sulfide contained in the compound. It is possible according to the inventive method to satisfactorily eliminate the objectionable odor from the structured compound by freezing the compound and then heating it.

Effective elimination of the objectionable odor will be impossible if the freezing or heating step alone is employed.

Alternatively, as described above with respect to the second and third embodiments, it will be possible to further enhance the deodorization of a structured compound by freezing the compound (or this freezing step may be omitted), and immersing it in a solution containing an oxidizing agent or a reducing agent, and heating it there.